

Model Comparisons of Aerosol Size Distributions with Solar Occultation Data

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Model Comparisons with SAGE II v6.10 Data for 1999

Extinction at 1.02, 0.525, 0.453, and 0.385 mm
- Equator, 47N, June

Extinction Ratios: 0.525/1.02, 0.453/1.02, 0.385/1.02
- Equator, 47N, June

Modeled Aerosol Size Distributions
- Equator, 47N, June, at 20,25, 30 km

Model Sensitivity to Aerosol Size Resolution

$V_{\text{rat}} = V_{i+1}/V_i$
Parameters: V_{rat} , R_{min} , N_{max}

V_{rat}	R_{min}	R_{max}	N_{max}
2.0	0.4 nm	2.5 μm	40
4.0	0.4 nm	2.5 μm	20
8.0	0.4 nm	2.5 μm	14
1.5	0.4 nm	2.5 μm	66
2.0	10 nm	2.5 μm	25

Model Sensitivity to Spatial Resolution

nucleation occurs in confined regions, not uniform zonally
as 2D models assume, therefore coagulation too weak in 2D

Description of AER 2-D Aerosol Model

see Weisenstein et al. (1997)

Gas Phase Sulfur Species:

DMS, H₂S, CS₂, OCS, SO₂, SO₃, H₂SO₄

Other Species:

O₃, NO_y, Cl_y, Br_y, N₂O, CH₄, OH, etc

Aerosol Microphysics: (sulfate only)

40 aerosol bins: 0.39 nm to 3.2 μm, volume doubling

Homogeneous nucleation, classical (Zhao and Turco [1995])

Heteromolecular condensation/evaporation (Jacobson [1999])

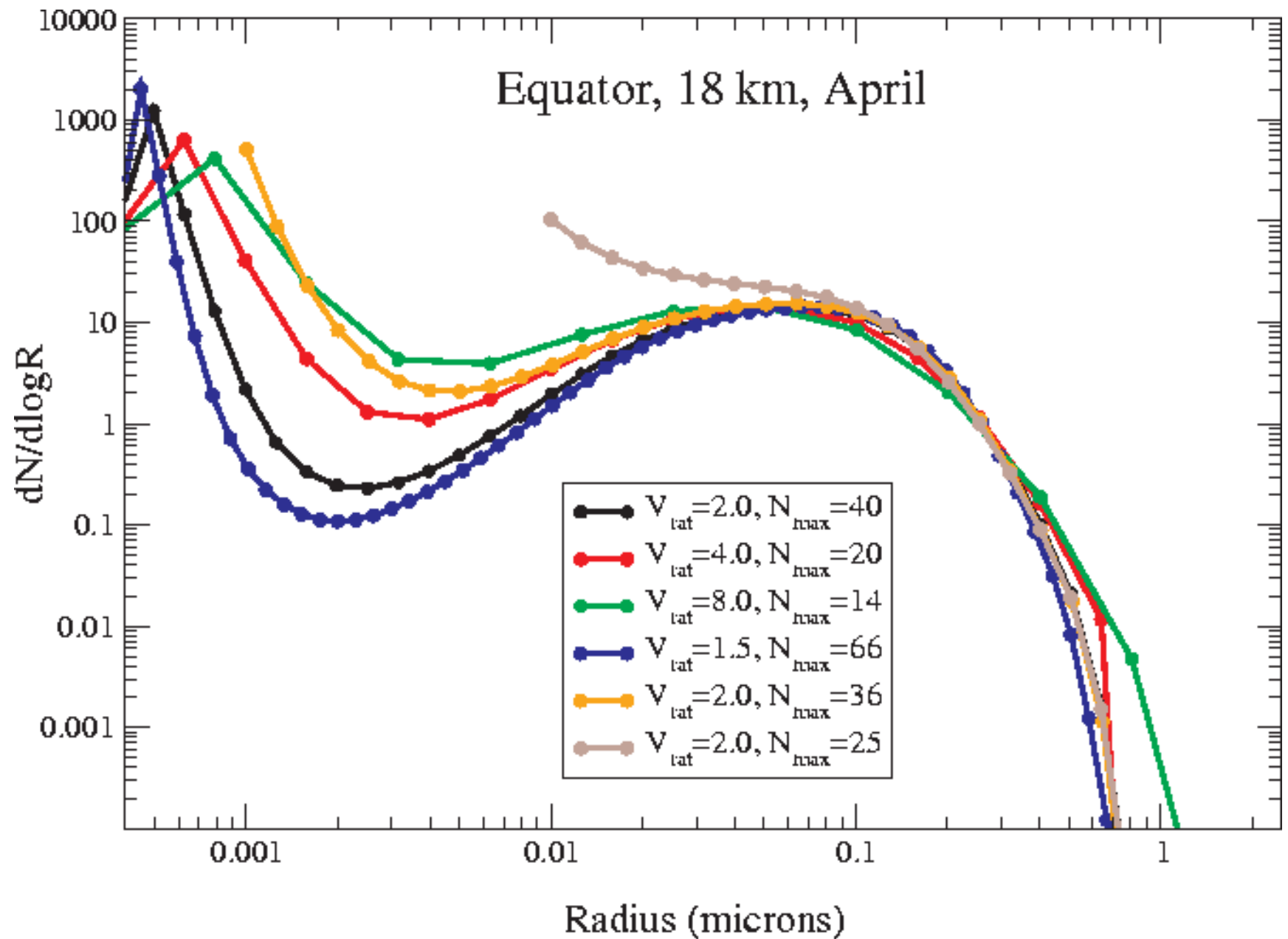
Coagulation (Yue and Deepak [1979])

Sedimentation (Kasten [1968])

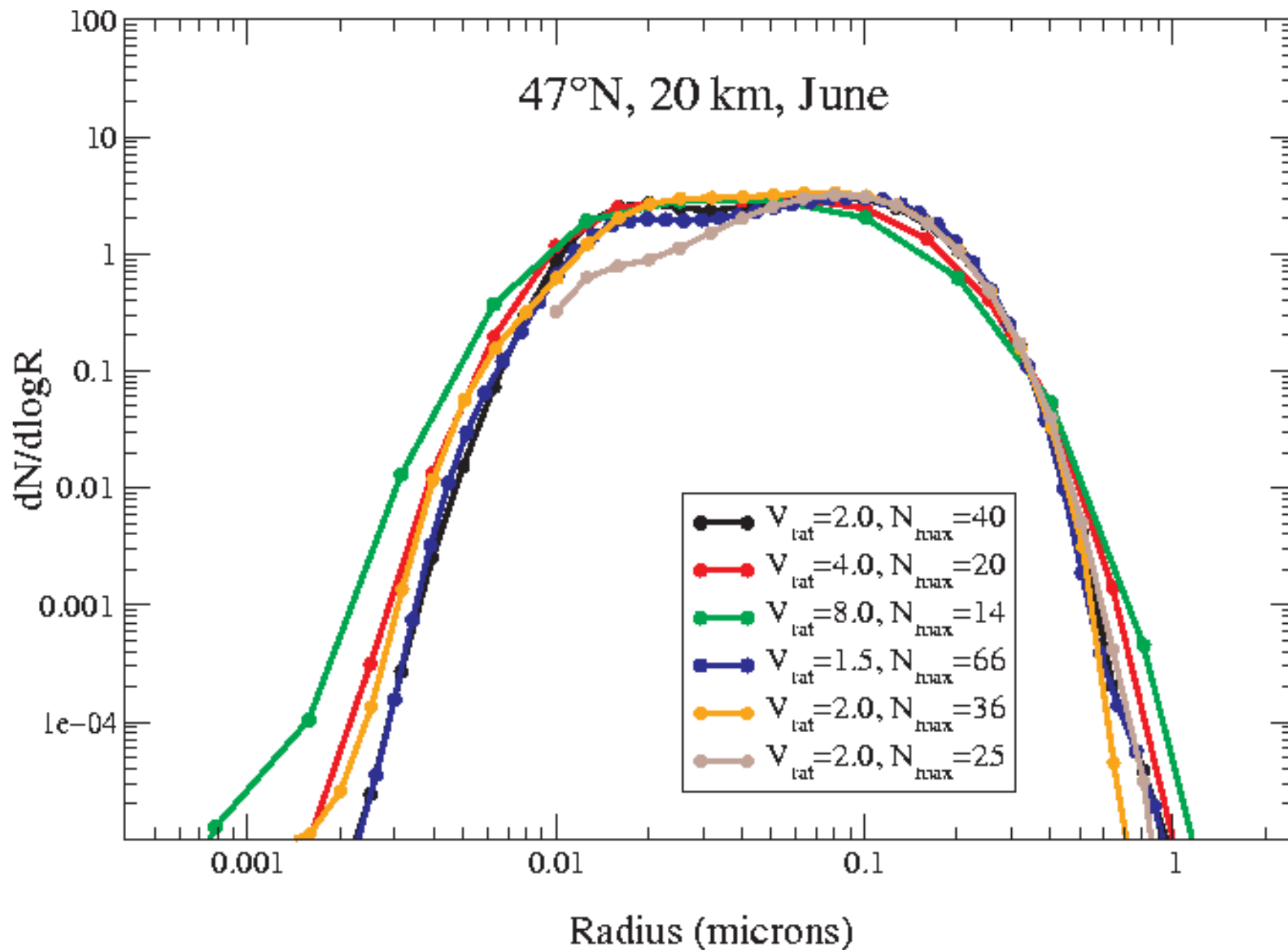
PSCs included in chemistry scheme, but no interaction with sulfate

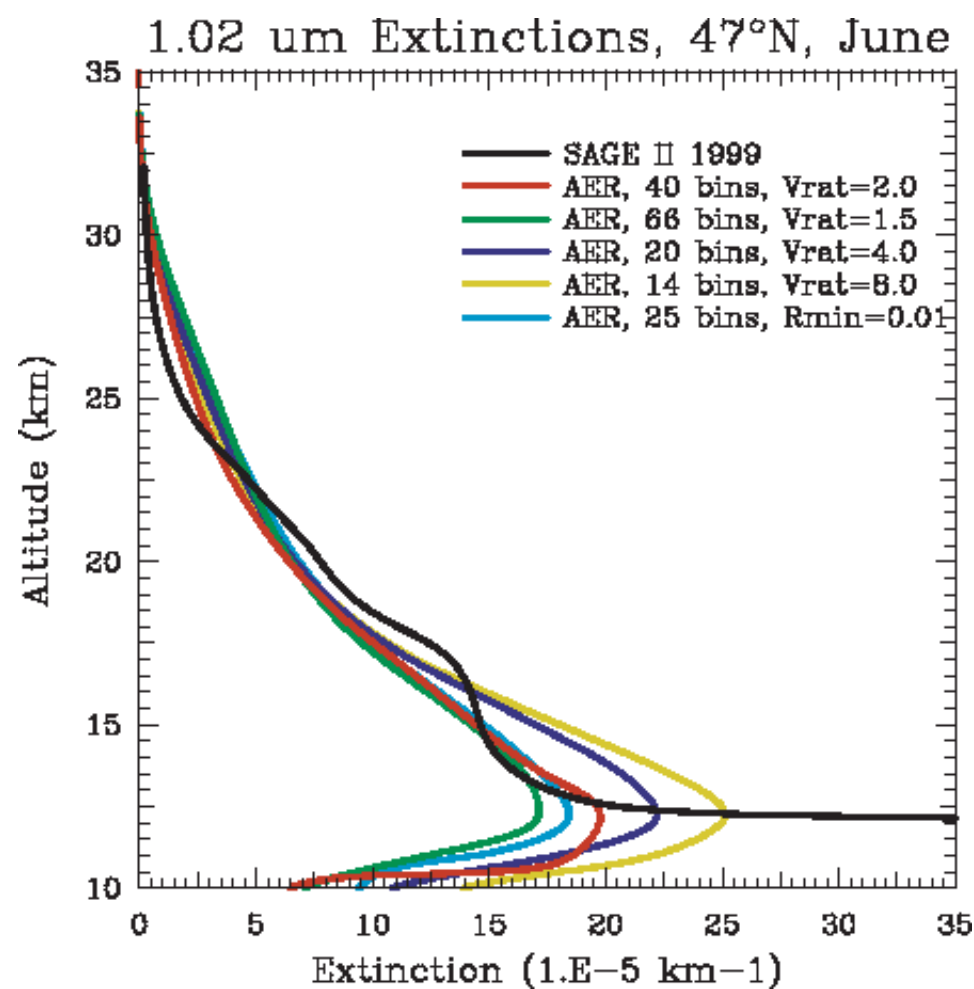
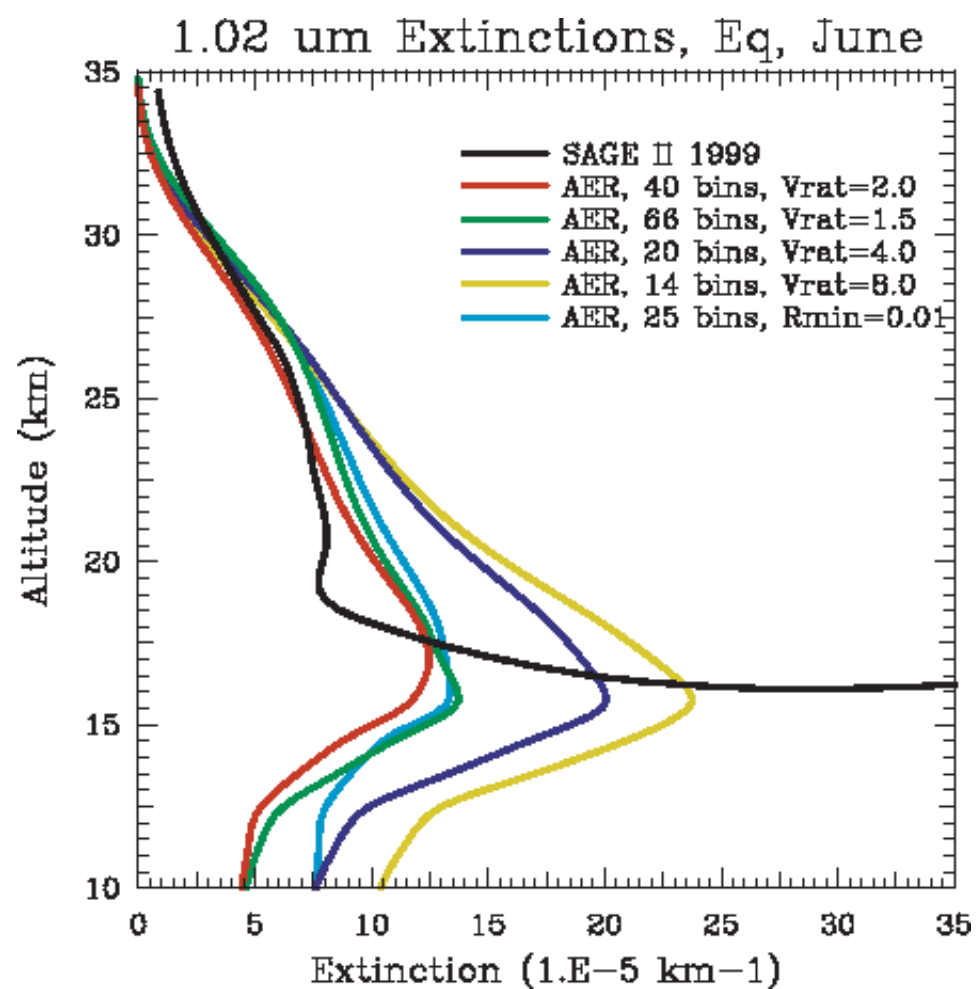
JPL-2000 chemistry

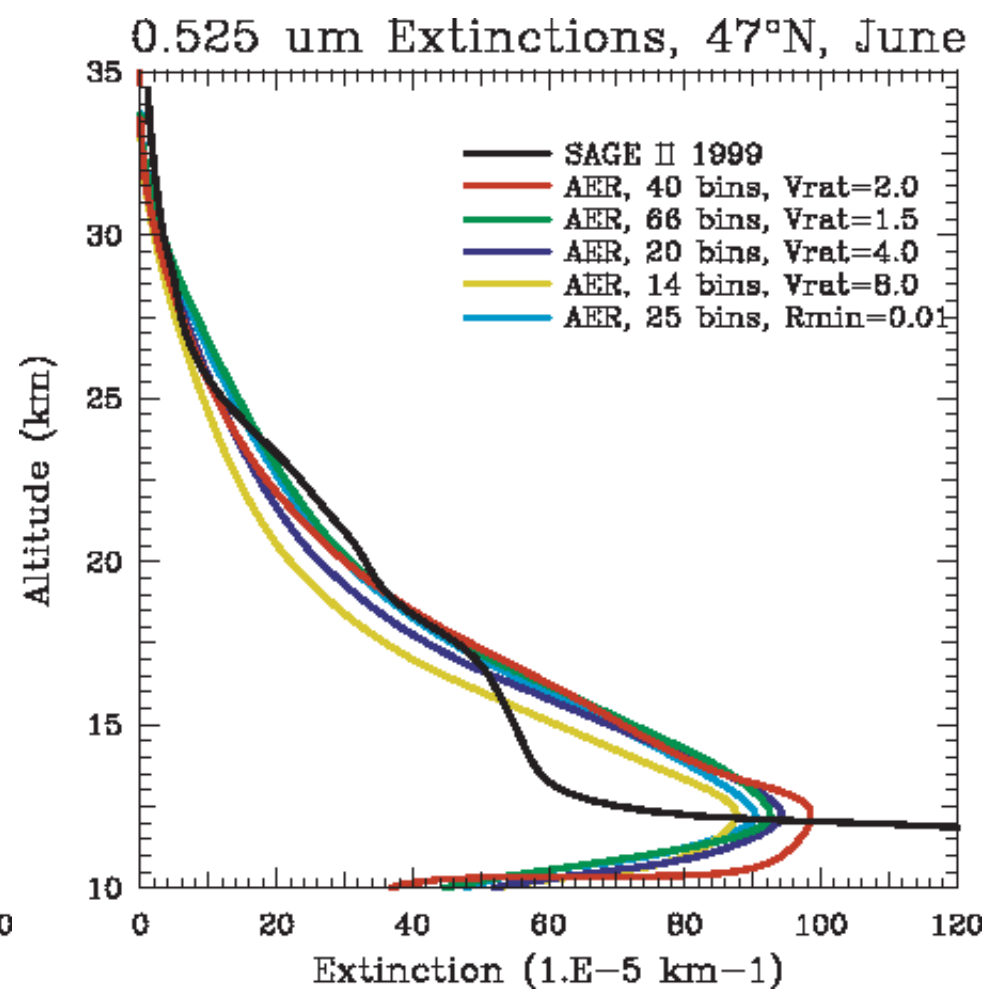
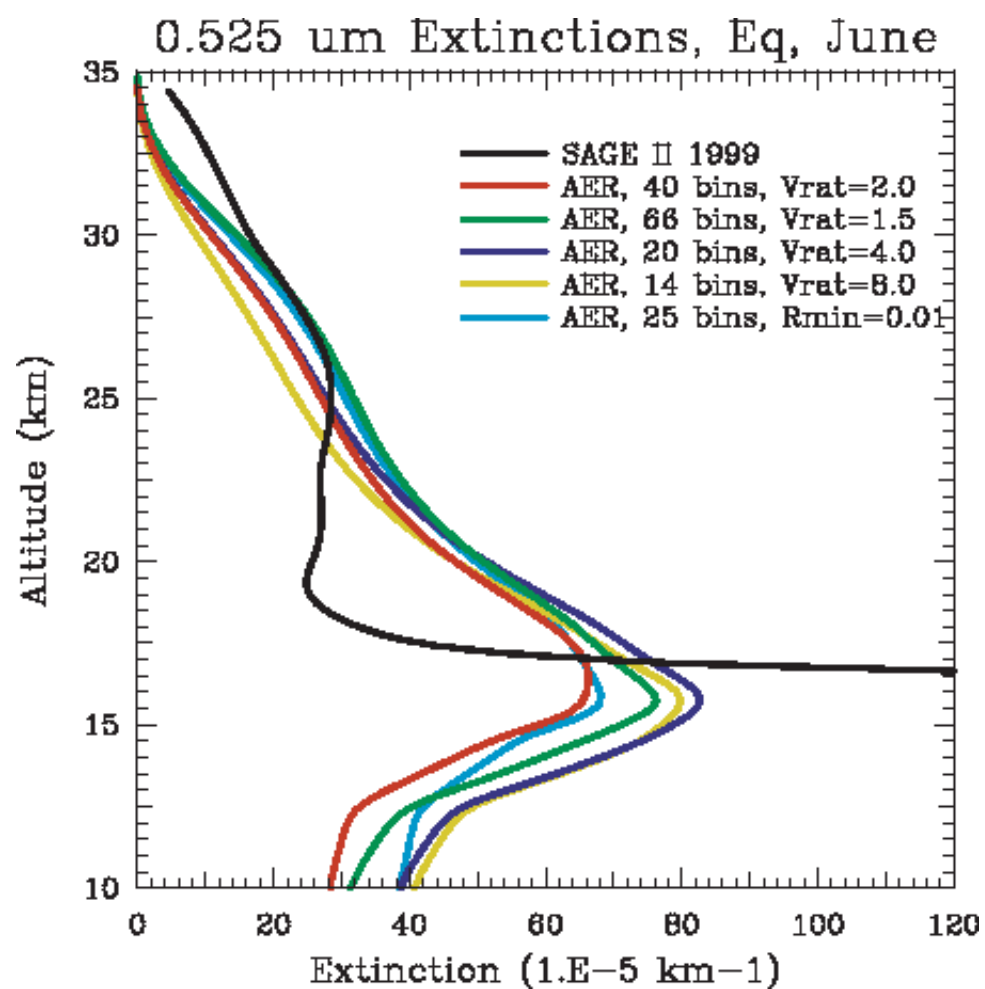
Size Distribution Differences

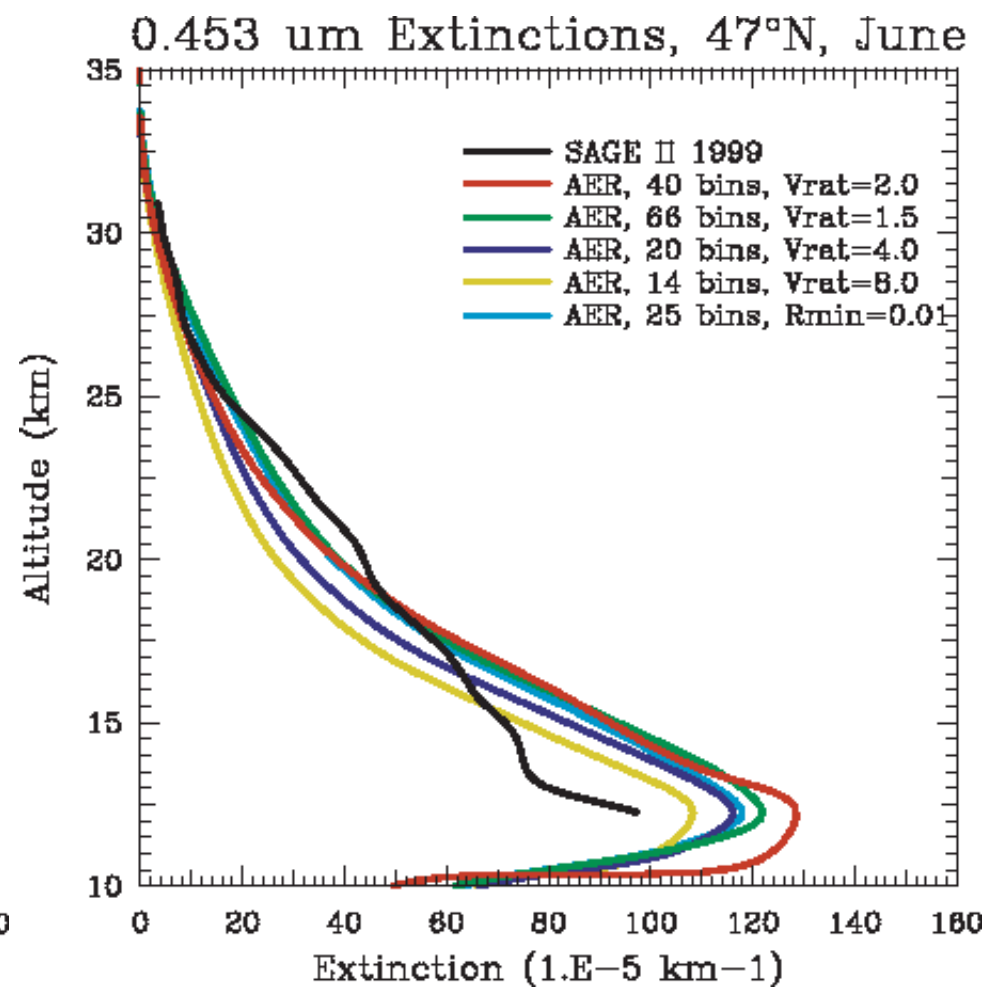
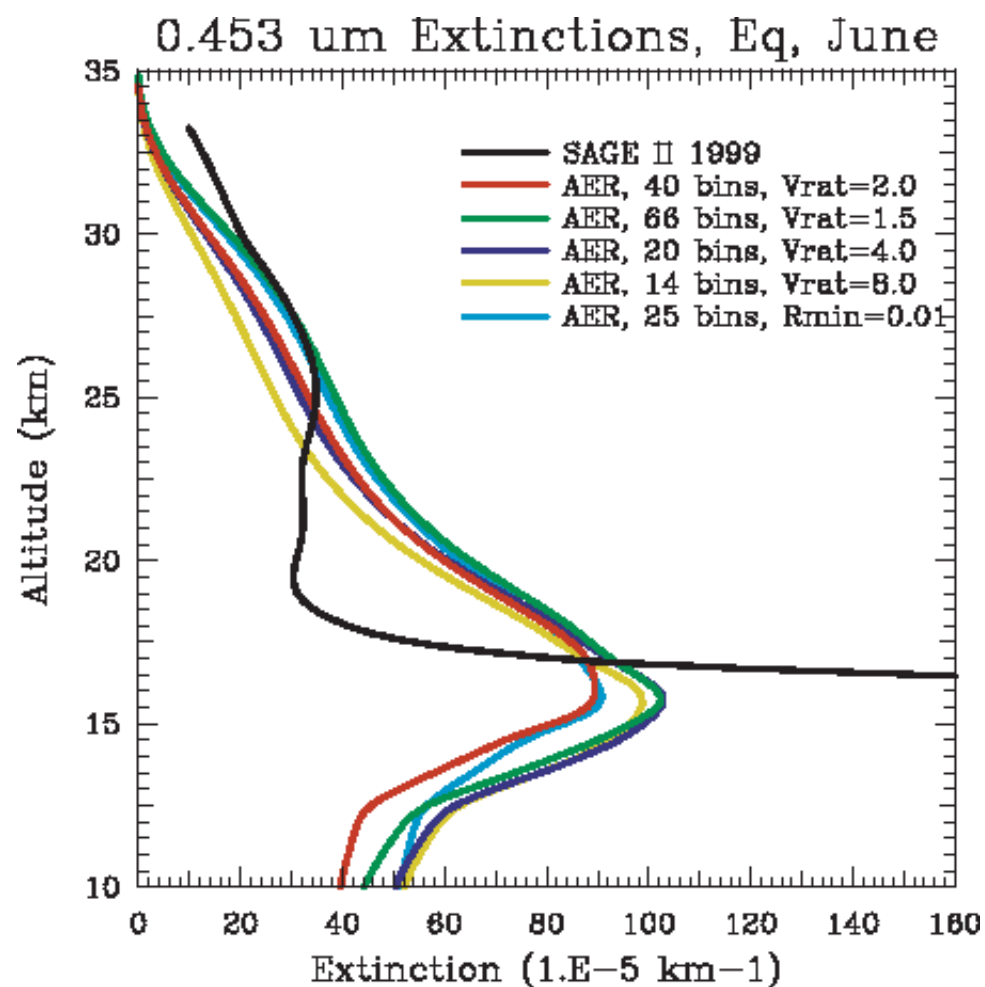


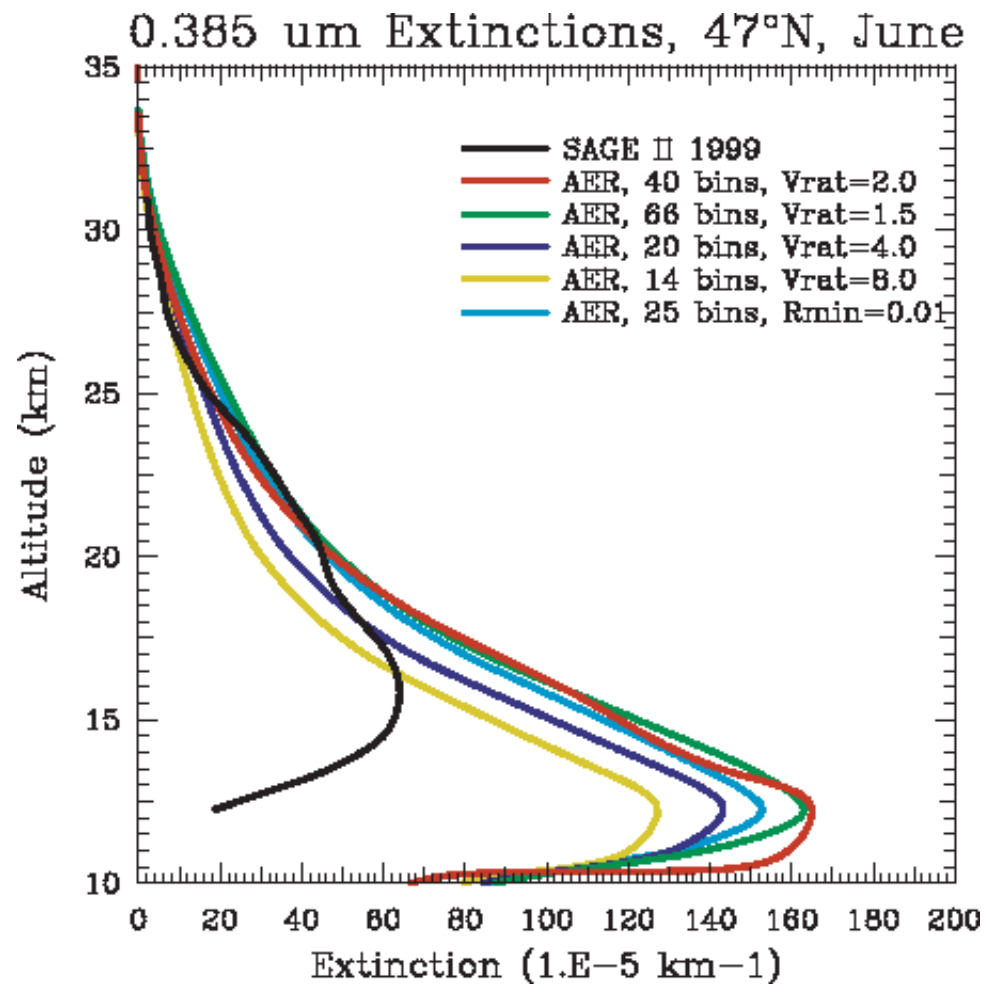
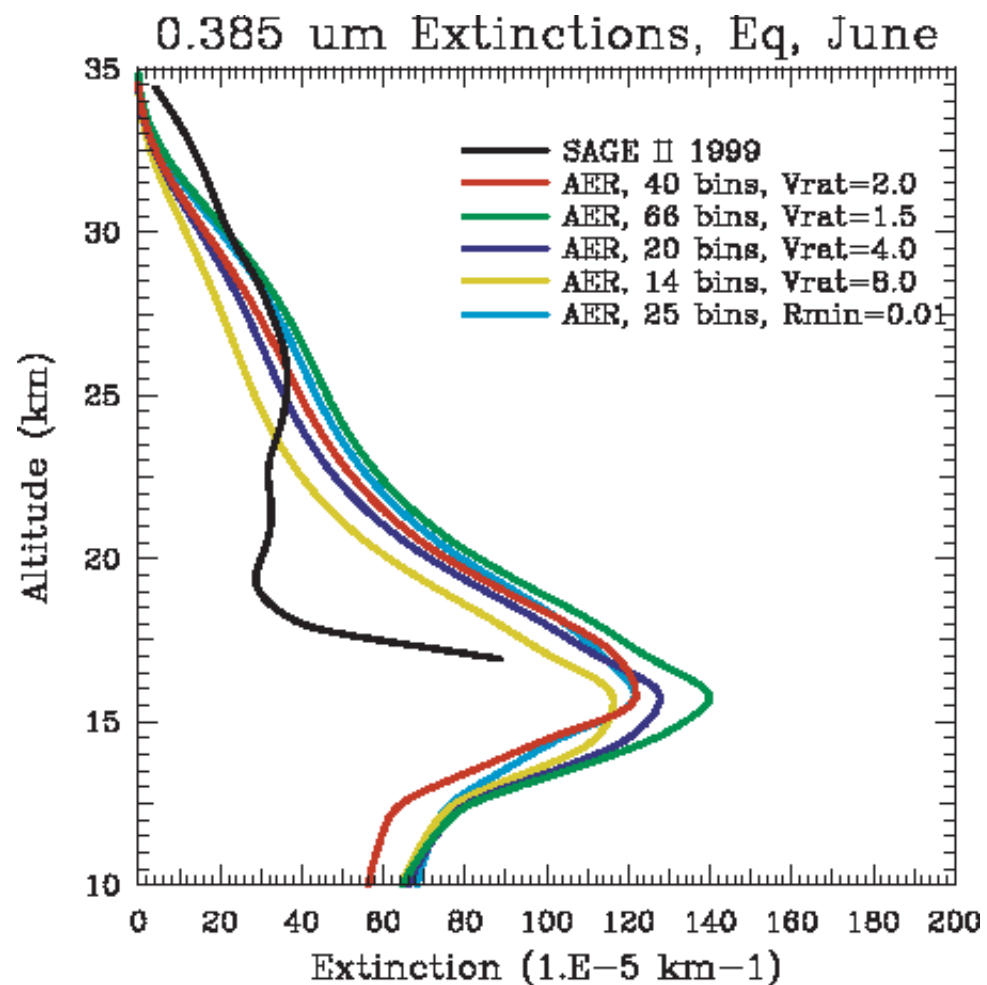
Size Distribution Differences

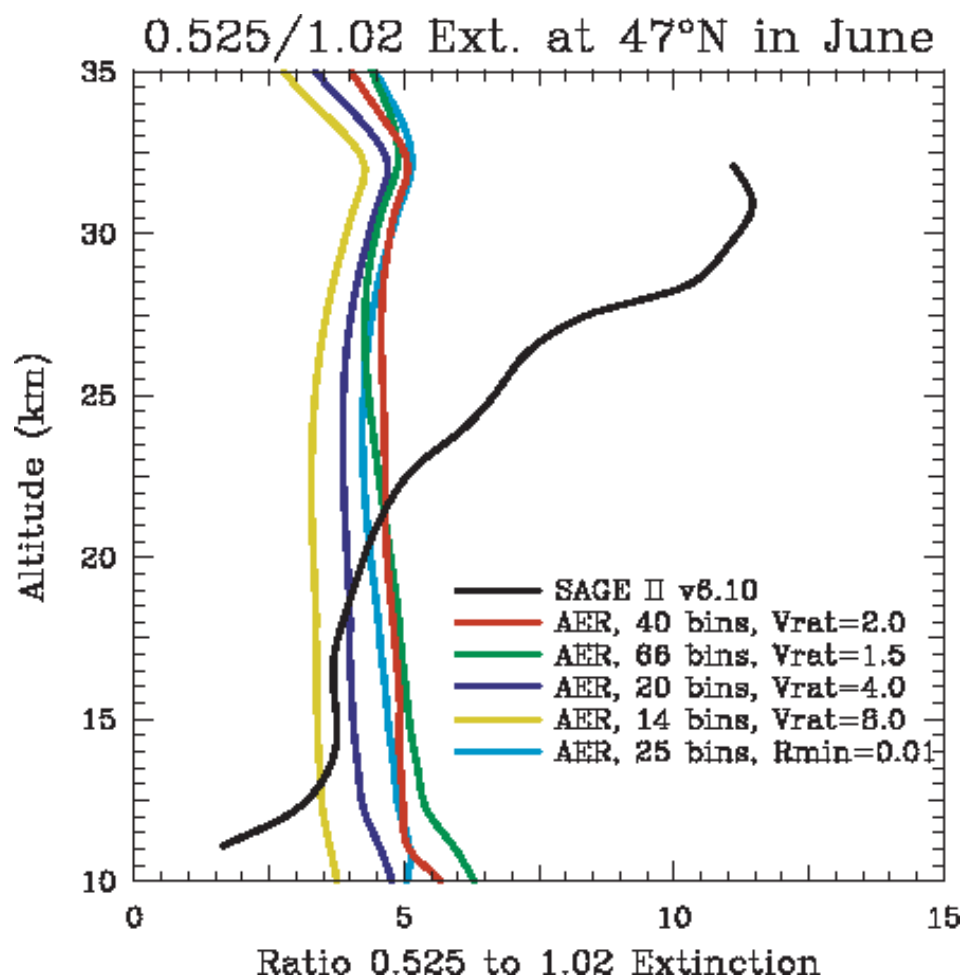
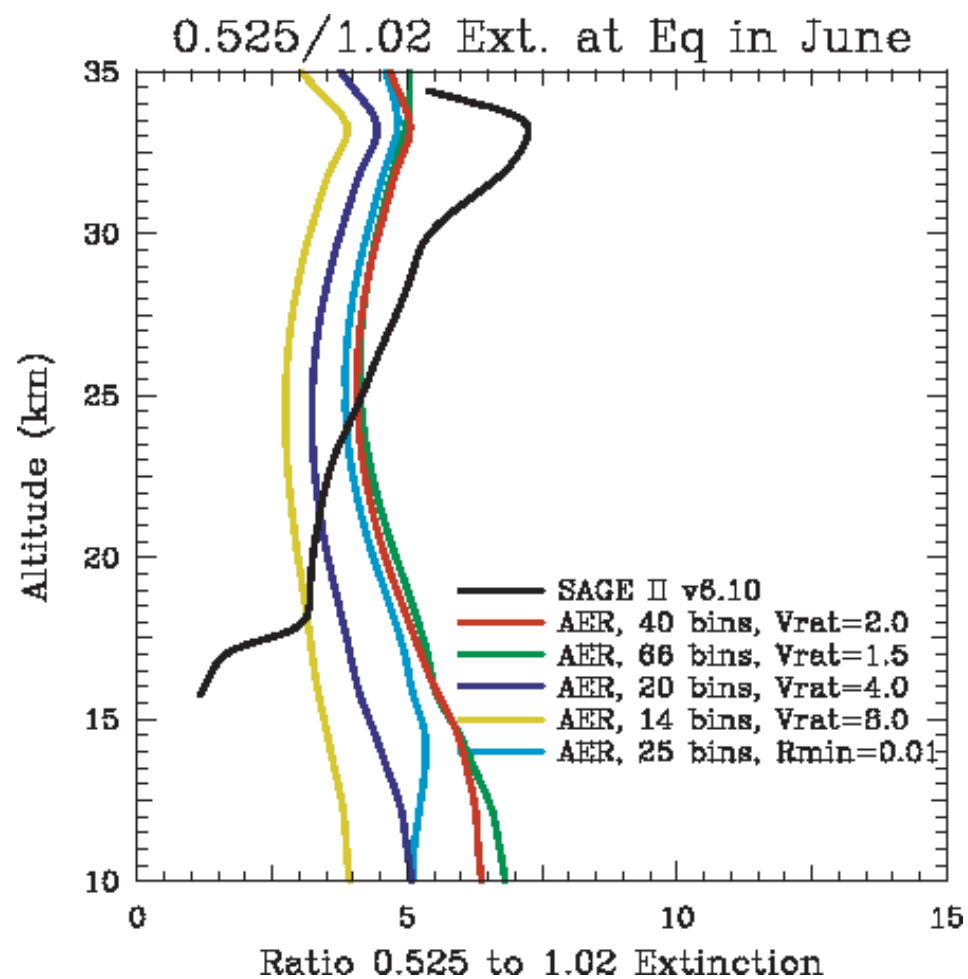


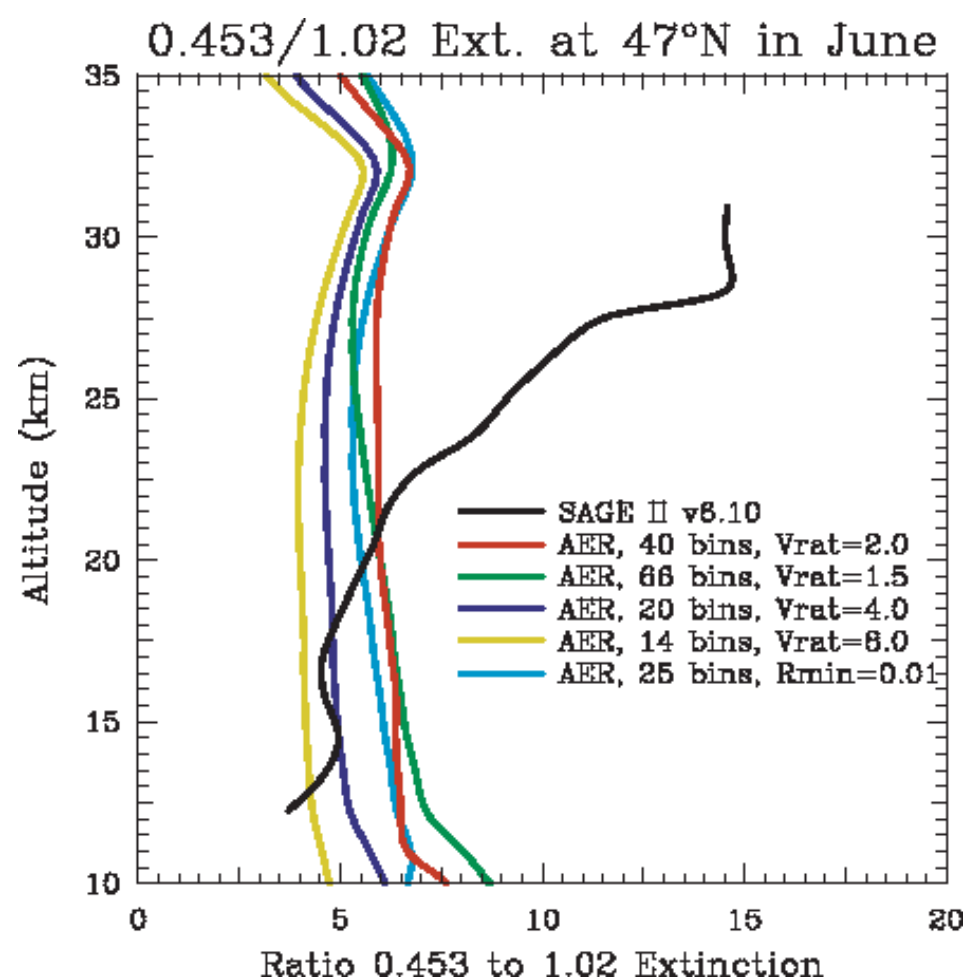
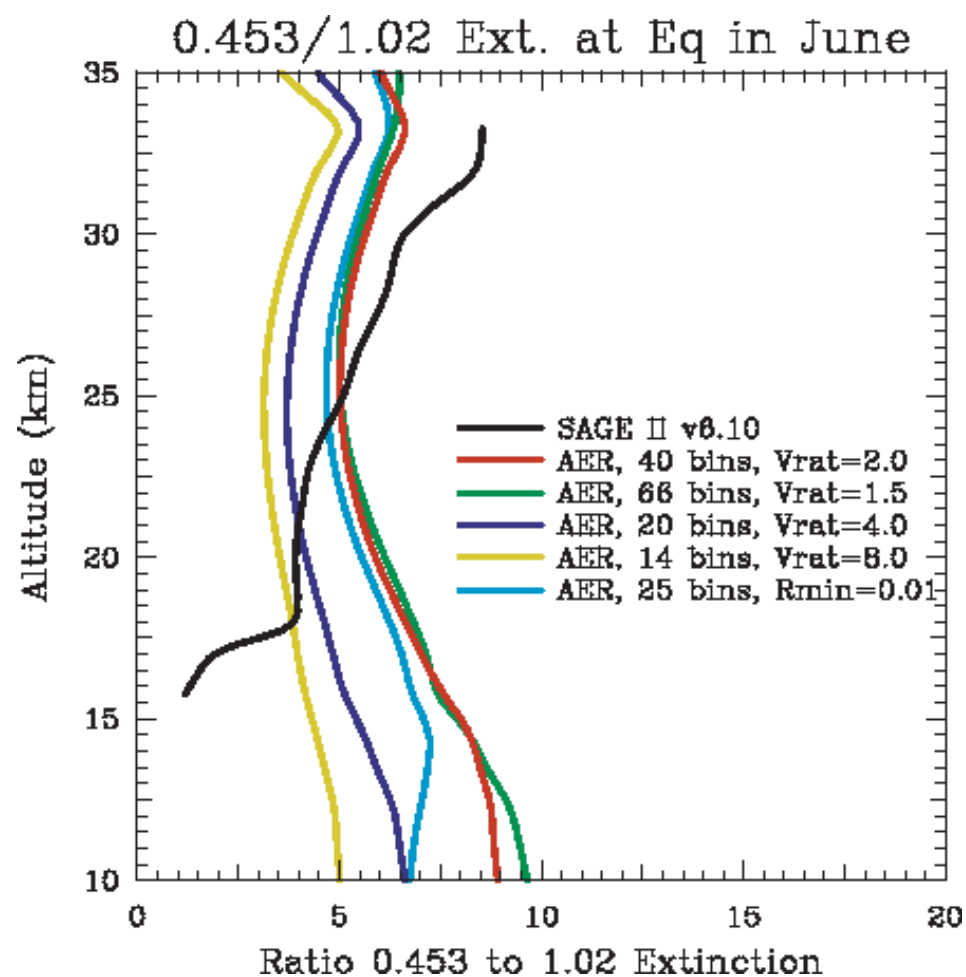


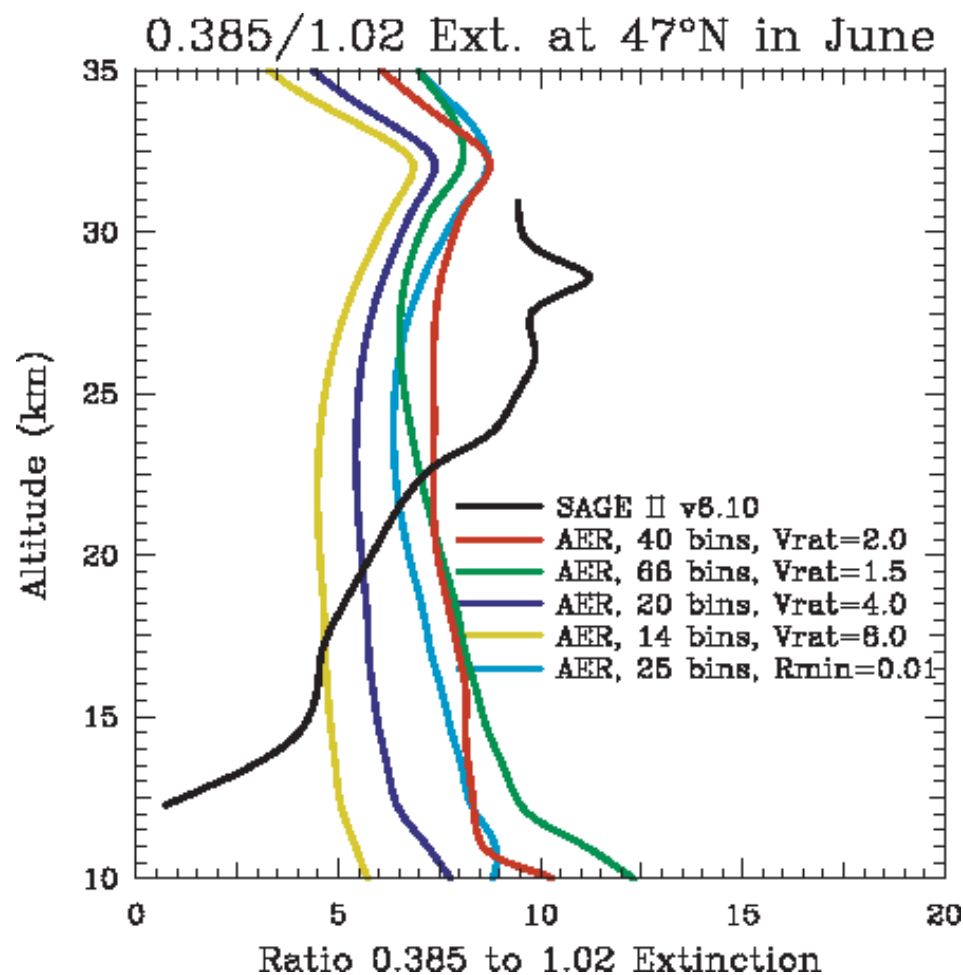
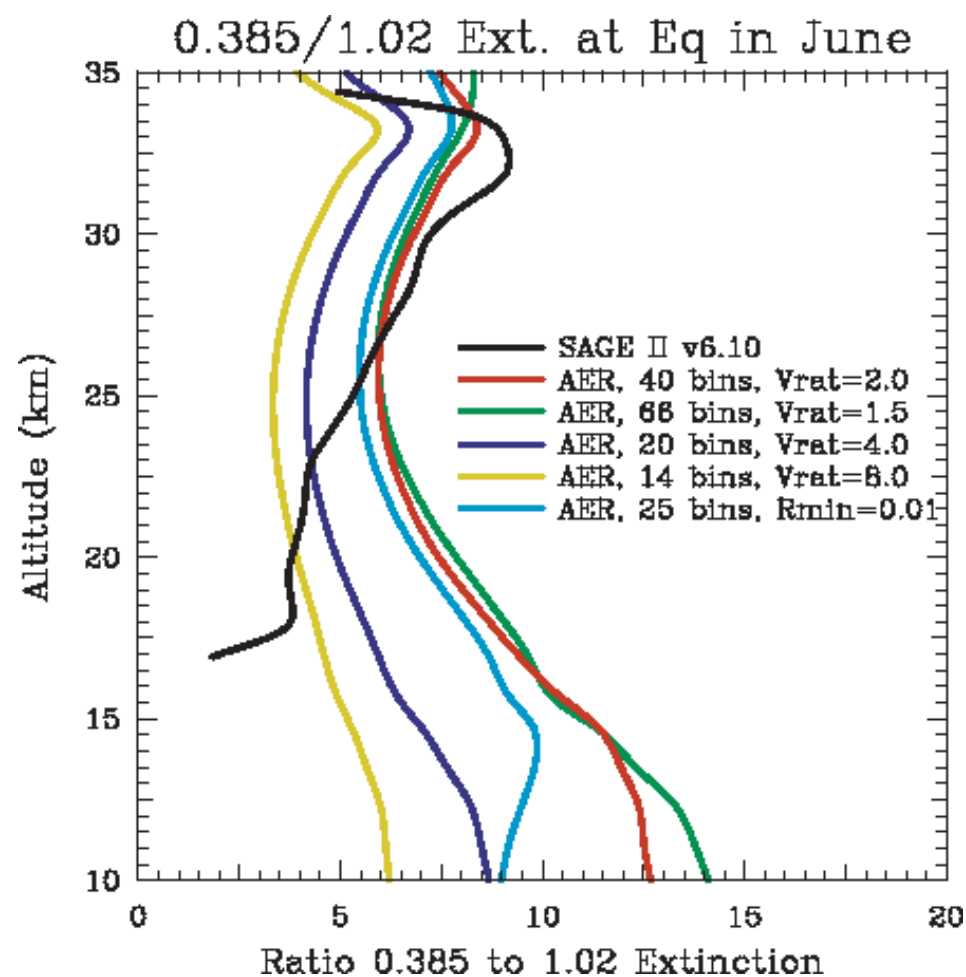


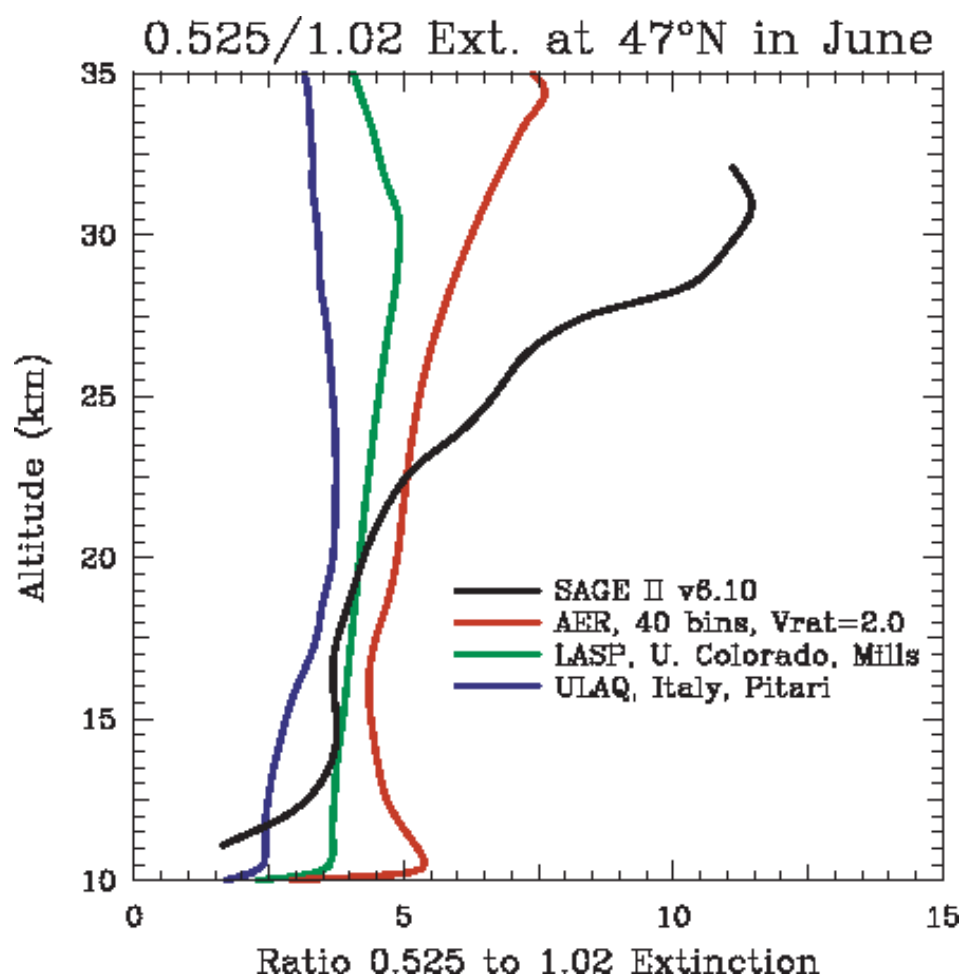
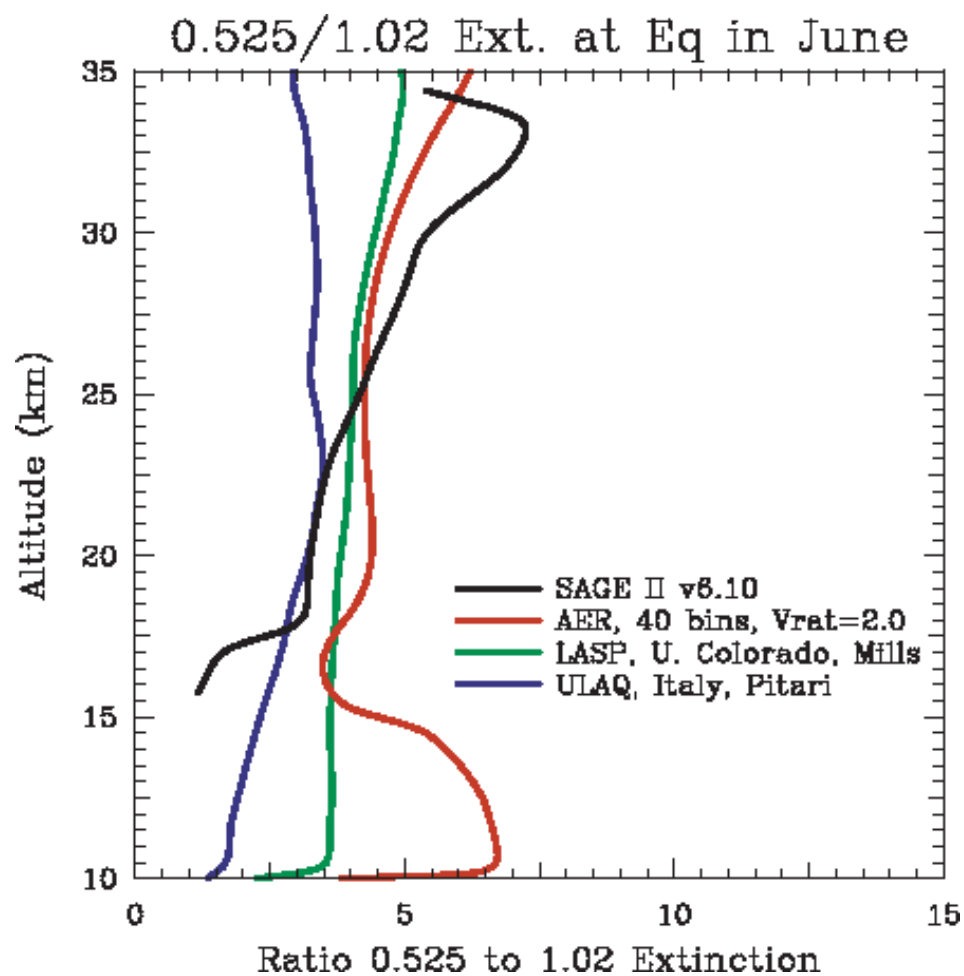






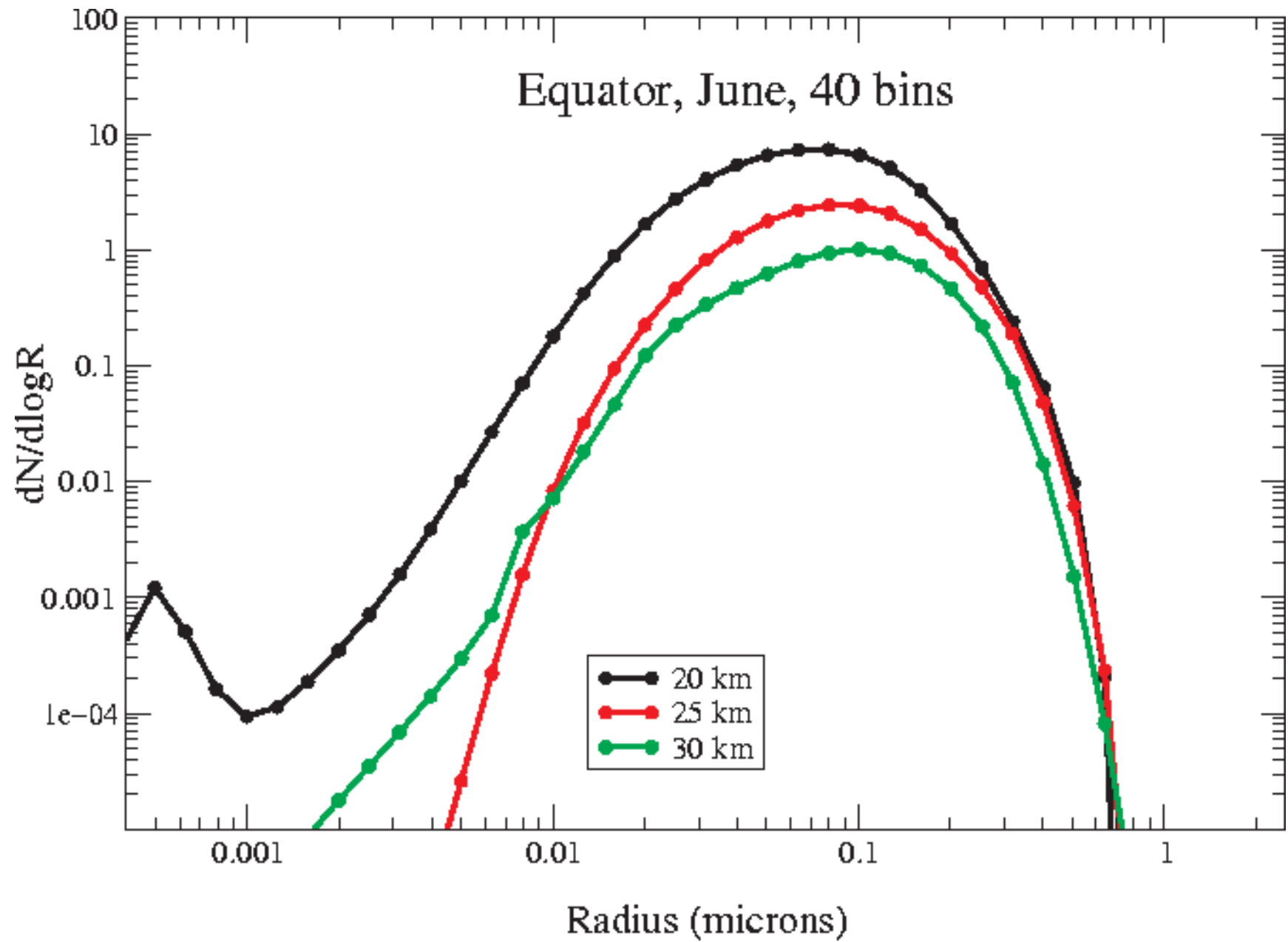




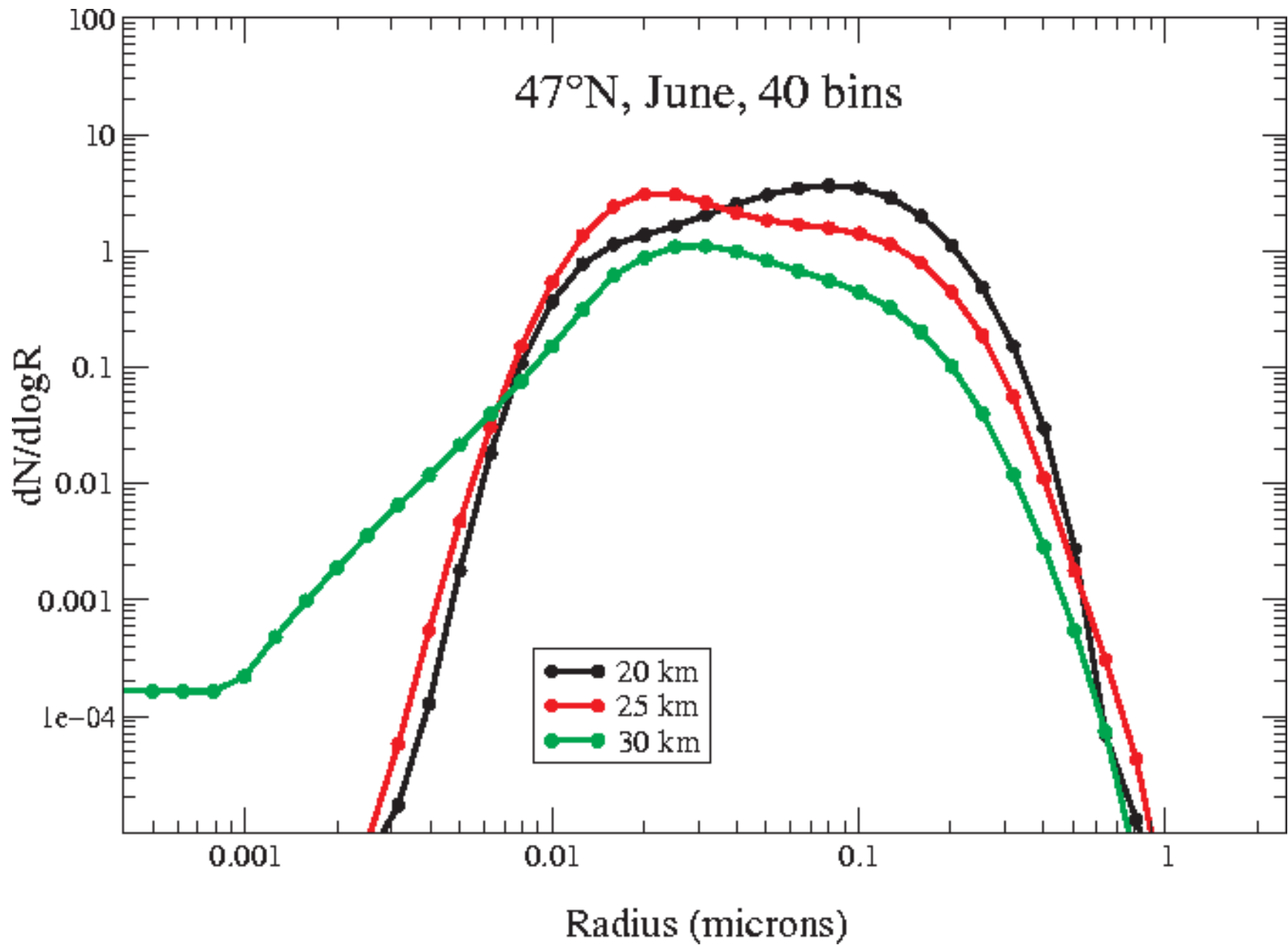


ULAQ model is 3-D, LASP is 2-D

Modeled Size Distributions



Modeled Size Distributions



Conclusions, Questions

Extinction ratios increasing with height are to be expected:
large particles sediment faster at higher altitudes
evaporation moves particles from large to small bins

Model extinction ratios have little gradient with height
problem with sedimentation?
problem with evaporation?
not aerosol size resolution problem
spatial resolution problem (one 3-D shows same problem)?

Is there a fundamental problem with our understanding of aerosol microphysics?